

U.S. Fish & Wildlife Service



7-Year Inventory and Monitoring Plan



Inventory and Monitoring 7-Year Plan: 2013-2020 For the National Wildlife Refuge System

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Introduction

The Refuge System I&M Initiative works with others to assess the status of refuge lands, waters, and biota, and supports achievement of conservation objectives at multiple spatial scales.

This *Inventory and Monitoring 7-Year Plan: 2013-2020* (7-Year Plan) outlines how the National Wildlife Refuge System (Refuge System) is implementing a nationally coordinated effort to support rigorous inventories and monitoring at the refuge, landscape, regional, and national scales. The Inventory and Monitoring (I&M) initiative collects and synthesizes information that supports management at multiple geographic scales and informs decisions at all organizational levels. The I&M initiative is designed to address the Refuge System's mission-critical information needs, and to help plan and evaluate the effectiveness of conservation strategies implemented by the U.S. Fish and Wildlife Service (Service) and conservation partners in the face of accelerating climate change and growing threats from other environmental stressors.

This 7-Year Plan steps down from the 2010 document, *Strategic Plan for Inventories and Monitoring on National Wildlife Refuges: Adapting to Environmental Change* and the 2010 *Operational Blueprint for Inventory and Monitoring on National Wildlife Refuges: Adapting to Environmental Change* (Blueprint). The Blueprint identified System-wide priorities that support the Service's landscape conservation efforts and response to environmental change. We are stepping-down the Blueprint to lay out a strategic, focused, and measurable prioritized plan for the next seven years.

Under the direction of the Natural Resource Leadership Team, we identified 19 operational goals, or focus areas, that encompass the System-wide priorities previously identified in the Blueprint. From a national perspective, we ranked these operational goals from high to low. The purpose of the prioritization was to identify immediate needs and enable us to focus on building the foundation needed to support monitoring at multiple scales. Because national priorities may shift over the next seven years, the operational goals are identified by their respective acronyms but are presented in priority order from highest to lowest.

The 7-Year Plan provides direction for the I&M initiative by identifying objectives, time-frames, and targets for each focus area that may be modified as we progress. An Annual Work Plan (AWP) will be stepped down from the 7-Year Plan and provides the detailed actions that the regions and national office will complete, based on the goals provided in the Plan. By design, the AWP will be dynamic and flexible, enabling us to adjust for previous results and modify the annual targets and tasks as appropriate. We envision that the 7-Year Plan will be formally reviewed approximately every 3 to 4 years.

The strategic goals presented below provide a unifying framework that defines how the I&M Initiative supports the mission of the Service and the goals of the Refuge System. These strategic goals establish a connection between the 19 operational goals (focus areas) and the fundamental mission and goals of the Refuge System (Figure 1). The strategy encompassed by the 7-Year Plan will guide the national and regional annual work plans, providing the prioritized focus and efficiency needed to maximize progress for the I&M initiative.

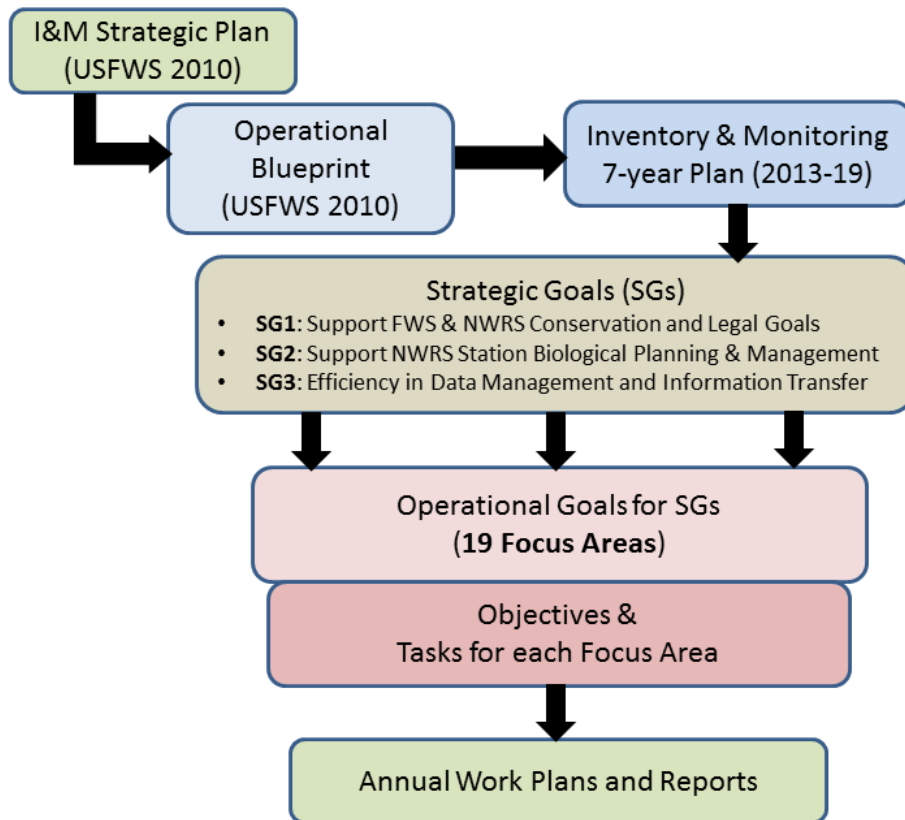


Figure 1. Schematic showing the relationships among the I&M Strategic Plan, the 7-Year Plan, and annual reporting.

Strategic Goal 1: Support the Service and Refuge System goals and legal requirements of:

- a. Assessing the status and trends of Refuge System natural resources (fish, wildlife, plants, and habitats).
- b. Assessing the impacts of anthropogenic and environmental stressors on natural resources of Service lands.

Operational Goals: Refuge Condition Assessment, Surrogate Species Monitoring, Vegetation Mapping, Wilderness Character Monitoring, Water Resources I&M, Phenological Monitoring, Wildlife Health, and Air Quality Biomonitoring.

Strategic Goal 2: Support development of biological objectives for station planning and management, improved management decisions through iterative learning, and landscape scale conservation by:

- a. Making available baseline data necessary to inform station and landscape level planning and assessments.
- b. Providing relevant scientific information to support planning and management decisions at field stations and at landscape, regional and national levels.
- c. Assisting with development of rigorous (i.e., relevant and clear) natural resource objectives for field stations (and in relevance to the landscape), and providing support to evaluate the effectiveness of management decisions in meeting those resource objectives.
- d. Assisting with development of high quality inventory and monitoring plans and survey protocols.
- e. Coordinating surveys and adaptive management projects at field stations and with other FWS Programs, partners, and LCCs.

Operational Goals: Adaptive Management, I&M Planning, Abiotic Data, Baseline Biotic Inventories, Bird I&M, Endangered Species Act Reporting, Fire Monitoring, Invasive Species I&M, and Coastal Marine Monitoring.

Strategic Goal 3: Maximize administrative efficiency, data management, information transfer, and coordination among field stations and regions, by:

- a. Supporting development of rigorous, well-designed, user-friendly data management systems.
- b. Supporting effective data sharing and discovery within the Service and with all partners.
- c. Supporting effective communication through a clear set of I&M staff roles and responsibilities that clarify the purpose and functions of the I&M Initiative within the Service and with partners.
- d. Supporting training that improves the technical and leadership skills of FWS staff at all levels.

Operational Goals: Data Management, and Systems Development.

I&M Planning (IMPI)

Goal: Provide field stations with the information and tools for planning and conducting defensible and management applicable inventories and monitoring.

IMPI 1.0 Every Refuge will have begun the development of Inventory and Monitoring Plans (IMPs) by the end of FY15.

IMPI 1.1 During FY13, the I&M Team (I&M Coordinators, I&M National Data Manager, and I&M Supervising Biologist) will help facilitate approval of the I&M Policy.

IMPI 1.2 Beginning in FY13, the I&M Team will work with regional and refuge staff to help Refuges prioritize resource management objectives and or conduct needs assessments in advance of developing an IMP. This task may include helping station staff revise existing objectives prior to prioritization.

IMPI 1.3 By the end of December 2013, the I&M Team will have piloted the IMP process and format on at least two refuges. The IMP development process (not the policy) will be evaluated each time and modified as necessary.

IMPI 1.4 By the end of FY15, 100% of IMPs will have been initiated e.g., at a minimum, updating PRIMR). Initiation of IMPs will proceed as follows: 10% of stations will have initiated production of an IMP by the end of FY13, 40% by the end of FY14, with 100% by the end of FY15.

IMPI 2.0 Every Refuge will have an approved IMP by the end of FY19.

IMPI 2.1 By the end of FY14, 10% of stations will have an approved IMP with an additional 20% annually thereafter; task will be completed by the end of FY19.

IMPI 3.0 Complete drafts of protocol frameworks at the national and regional scale and archive them in Service document catalog (ServCat) by the end of FY15. This task requires coordination with the Bird Inventory and Monitoring Objective 2.0.

IMPL 3.1 By the end of FY13, the I&M Survey Protocol team will finalize the Survey Protocol Handbook and provide several examples of protocols from which to work.

IMPL 3.2 By the end of FY13, the landbird and marshbird protocol framework will be completed and made available in ServCat by NRPC for site-specific application.

IMPL 3.3 By the end of FY15, the NRPC I&M Team will use PRIMR and approved IMPs to identify commonalities to help guide which protocols to target for national development.

IMPL 3.4 Beginning in FY15, the NRPC I&M staff will begin protocol development on at least two additional national framework protocols. Target completion for this task will be developed at this time.

IMPL 4.0 In collaboration with Planning and refuge staff, the I&M team will initiate a process to provide assistance toward the integration of the IMP with new CCP and HMPs by the end of FY13.

IMPL 4.1 The I&M and Planning Chiefs will hold a joint meeting in December 2012 to identify at least one situation where monitoring data could be used to better inform the next round of CCPs.

IMPL 5.0 Develop guidelines in the form of Standard Operating Procedures (SOP) that specifically describe all of the components (e.g., data types, sources, criteria under which the

information should be compiled and summarized and presented, etc.) of the Station Portfolio, including the coordination needed with various Service program and partners; and description of core team members who are responsible for developing the portfolio (e.g., roles and responsibilities of I&M staff, refuge staff, planning division staff, etc.).

IMPL 5.1 By the end of FY15, NRPC I&M staff and regional I&M coordinators, working closely with the Refuge Planning division staff at HQ and regions, will identify the relevant end users, the information to be summarized, the source of the information, etc., and begin development of the SOP or guidance that will be most useful to the end users.

IMPL 5.2 By the end of FY15, NRPC and I&M coordinators will coordinate with the Refuge Planning division at HQ and regions to complete a schedule of conservation plans (LCD, CCP, HMPs, IMPs and other step-down plans) and begin pilot phase of developing the Station Portfolio for a subset of refuges in each region.

Why is I&M doing this?

- IMPs are necessary to ensure refuges have scientific rigor for making management decisions.
- Data collected on the refuge are not organized and catalogued where they are easily accessible for analysis and/or interpretation. Uploading all of this information and materials into ServCat will help to organize everything into one accessible location, but stations will still need assistance in synthesizing, analyzing, and interpreting the data and information.
- Some of the relevant information is contained in reports or vulnerability assessments developed by other entities, summarizing information from larger spatial scales (states, LCC's, Joint Ventures, NABCI, etc.), which may be missed or overlooked by planners and others within the refuge system.

What advantages/benefits will refuges and managers see as a result of implementation?

- To provide a clear connection between the various field surveys and management actions.
- To provide a tool that refuge managers can use to document and justify their monitoring priorities.
- An approved IMP provides the roadmap for meeting the goals and objectives of the Refuge CCP and ensures continuity over time and through staff turnover, which increases efficiency and reduces monitoring time and cost.
- IMPs will be of value in documenting and cataloguing the history of a refuge's monitoring effort over time.
- Streamlines the pre-planning process for refuge management plan development.
- We will have a strategic process that is cross-programmatic to integrate all the sciences (planning, water resources, and biology) to develop comprehensive pre-planning preparation that meets the needs of refuges engaged in revising CCP's, and HMP's.

Management Recommendations and Underlying Assumptions

- Policy approval is needed to achieve the goals set for IMP development.
- Ensure refuge staffs have the time required to complete PRIMR and IMP development
- A primary focus of the I&M initiative is developing scientifically defensible information for refuge management - the IMP requires examination of current needed surveys.
- Refuges must have clear, prioritized resource management objectives before IMPs can be useful.

Vision for next phase (where we will go from here)

- We will work with refuge staff to complete the initiated IMPs.
- Existing information needed for refuge planning and management will be easily accessible in one location, designed to help field stations, Service programs and division staff to think ahead about the vision, goals and objectives, and desired outcome for the individual station as well as how it contributes to the larger landscape conservation.

I&M Planning - visual display of task time line										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
IMPI 1.0											
	1.1									medium	medium
	1.2									low	very high
	1.3									low	low
	1.4		10%	40%	100%					medium	very high
IMPI 2.0											
	2.1			10%	20%	40%	60%	80%	100%	low	very high
IMPI 3.0											
	3.1									medium	low
	3.2									medium	low
	3.3									low	minimal
	3.4									medium	low
IMPI 4.0											
	4.1									low	low
IMPI 5.0											
	5.1									low	medium
	5.2									low	medium
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Water Resources Inventory and Monitoring (WRIM)

Goal: Provide innovative, relevant, and timely water resources information, assessments, and guidance to refuge staff, regional and national management, and partners to inform refuge management decisions and help meet refuge legal requirements.

WRIM 1.0 Implement the Water Resource Inventory and Assessment (WRIA) application and continue to conduct WRIAs.

WRIM 1.1 By the end of FY14, the Water Team will develop guidance document for consistent implementation of WRIA application.

WRIM 1.2 By the end of FY14, the Water Team, in collaboration with refuge and NRPC staff, will enter data into the WRIA application for at least two NWRs per region, including relevant water resource geospatial information.

WRIM 1.3 By the end of FY15, the Water Team will evaluate the WRIA process for efficiency and effectiveness.

WRIM 1.4 Complete 12 new WRIAs in FY13, increase number completed each year to 32 in FYs17-19.

WRIM 2.0 Provide field stations with site-specific information regarding historic wetland processes, perturbations to these processes, and frameworks for wetland restoration. This information will be incorporated into management decisions and provide information relevant to both on-going refuge management and future planning efforts.

WRIM 2.1 Beginning in FY13, the Water Resources and I&M Teams will develop a strategy for improving regional in-house capacity for conducting Refuge System “wetland reviews”. Wetland reviews are a format for developing historic wetland process models for a given wetland system and developing strategies to restore these functions. By the end of FY13, these teams will develop a Wetland Review training plan and schedule for implementation.

WRIM 3.0 Develop a coordinated water quality and quantity monitoring system for the Refuge System to be fully implemented by the end of FY19.

WRIM 3.1 By the end of FY13, the Water Team will identify national water monitoring objectives.

WRIM 3.2 By the end of FY14, the Water Team will evaluate, in the context of meeting national objectives, the results of the eight water monitoring pilot projects that were initiated in FY12.

WRIM 3.3 By end of FY 13, the Water Team will make recommendations to Refuge System leadership regarding a national, centralized data system for water monitoring data.

WRIM 3.4 By the end of FY 17, the Water Team will complete the following steps towards the development of a water monitoring network for the Refuge System:

- Develop specific criteria for evaluating water information needs at both the refuge and national level. Criteria should be derived from key water monitoring objectives outlined in WRIM 3.1 and identify stations capable of informing status and trends assessments in water quantity, water budget, and water quality at multiple scales.
- Use the criteria to identify existing water monitoring stations (both Service and non-Service supported) deemed to be critical to refuge-level and national-level water information needs.
- Assess information gaps at the refuge and national-level where monitoring stations are unavailable to address near and long-term water data needs.

- Prioritize existing and future water monitoring stations and develop a strategic plan for implementation and long-term support of a national water monitoring network.

WRIM 3.5 Beginning in FY13, the Water Team will identify national-level protocols for water quantity and quality monitoring and implement these as appropriate. This task will be on-going.

Why is I&M doing this?

- Most refuges were set aside for wildlife resources that depend on water. Trust species (interjurisdictional fish and many migratory bird species) rely on aquatic habitats. We must have a basic understanding of the water quality and quantity across the System so that we can better inform current and future water management activities at the station and landscape scale.
- We need this information to meet our basic mandates – such as "Acquire, under State law, water rights that are needed for refuge purposes".
- Water availability is expected to change radically with climate change and we need to be able to document the current quality, quantity, timing and distribution of our water resources.
- Monitoring data informs refuge management and allow us to protect Refuge System water supplies to fulfil refuge purposes and the System mission. Refuge System water monitoring data are collected with documented methodologies, with known rigor and accuracy, and contribute to broader water quantity and quality monitoring networks.
- A standardized data management system is necessary for proper storage, retrieval, and sharing of Refuge System water monitoring data.

What advantages/benefits will refuges and managers see as a result of implementation?

- With a basic understanding of the water quality and quantity across the System we will be able to better inform current and future water management activities at the station and landscape scale.
- WRIAs provide information useful for management at refuge, regional, and national scales and are a valuable tool for prioritizing water monitoring activities.
- Staff efficiencies will be gained as I&M develops a set of documented methodologies, with known rigor and accuracy that can be easily applied at the station level.

Management Recommendations and Underlying Assumptions

- Assistance in obtaining water rights information for refuges will be needed in certain cases.
- Population of ServCAT with water management related documents will facilitate development of WRIAs.
- Integrate expertise from ES-Contaminants necessary to develop water quality monitoring protocols water quality assessments.
- Need assistance from Hydrologists and/or Surveyors for invert elevations of water control structures, water sampling locations, and wetland bottom topography.
- The trade-off between expediting the water resources inventories and taking the time to do a good job with the 'assessment' piece must be recognized. Refuge managers say what they really need is the assessment. An inventory alone has minimal value.
- Collaboration with Fisheries and ES will be crucial.
- Water quality monitoring is expensive. To best leverage funds, we must be strategic and involve partners and existing monitoring networks

- Regional consistency in water resource staffing and supervision is needed for consistent implementation of a nationally coordinated water quality monitoring and assessment initiative.
- Writing WRIA narratives for every refuge requires specialized expertise. Current I&M capacity and competencies are limited. Delivery of these objectives and action items depends on additional staffing to complete in a timely manner. Without staffing alignment and additional resources management may be dissatisfied with progress.

Vision for next phase (where we will go from here)

- The National Wildlife Refuge System has a long-term, coordinated effort monitoring water quantity and relevant water quality measures across the System. We have a monitoring effort and national data management system that allows us to describe current conditions and detect trends in Refuge System water supplies and multiple measures of water quality.

Water Resources Inventory and Monitoring - visual display of task time line										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
WRIM 1.0											
	1.1	Blue fill	Blue arrow	Red fill						medium	medium
	1.2	Blue fill	Blue arrow	Red fill						minimal	medium
	1.3		Blue fill	Blue arrow	Red fill					medium	medium
	1.4	12	12	16	24	30	32	32	32	medium	high
WRIM 2.0											
	2.1	Blue fill	Red fill							medium	medium
WRIM 3.0											
	3.1	Blue fill	Red fill							low	low
	3.2		Blue fill	Red fill						medium	medium
	3.3	Blue fill	Red fill							medium	medium
	3.4		Blue fill	Blue arrow	Blue arrow	Blue arrow	Red fill			medium	medium
	3.5		Blue fill	Blue arrow	Blue arrow	Blue arrow	Blue arrow	Blue arrow	Blue arrow	high	high
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Data Management (DM)

Goal: Ensure that I&M database modules are efficiently utilized by all stations and they contain accurate, relevant, complete and current data that are accessible to others and inform Refuge System management decisions.

DM 1.0 By the end of FY17, I&M protocols, Refuge annual narrative reports and high priority management plans will be documented and uploaded into ServCat, and ongoing ServCat record creation will be routine.

DM 1.1 By the end of FY13, the NRPC I&M staff will take the lead to develop guidelines for documenting and uploading I&M protocols, Refuge annual narrative reports and high priority management plans into ServCat.

DM 1.2 Beginning in FY13, 20% of the priority legacy documents identified in DM 1.1 will be entered into ServCat annually; task will be completed by the end of FY17.

DM 2.0 By the end of FY14, all Refuges will describe their current I&M survey activities in PRIMR and maintain this information annually.

DM 2.1 By the end of FY13, 50% of stations will describe their current I&M survey activities in PRIMR and maintain this information annually.

DM 2.2 By the end of FY14, 100% of stations will describe their current I&M survey activities in PRIMR and maintain this information annually.

DM 3.0 By the end of FY18, species occurrence data for birds, mammals, and vascular plants will be entered into the species database module for all Refuges. This task requires coordination with BBI 1.0.

DM 3. 1 By the end of FY14, develop guidelines for entering species occurrence data for birds.

DM 3. 2 By the end of FY16, at least 25% of refuges will enter and maintain their species occurrence data for birds, mammals, and vascular plants annually.

DM 4.0 Provide guidance, new tools, technical support and data management for I&M database modules.

DM 4.1 Beginning in FY13, National and Regional data management staff will provide technical support to end users as needed.

DM 4.2 Beginning in FY13, NRPC I&M staff and Data Managers will perform periodic quality control of data.

DM 4.3 Beginning in FY13, National and Regional data management staff will generate customized reports as needed.

DM 4.4 By the end of FY13, National Data Manager will provide national data management guidelines to the regions in order to facilitate the development of regional data management plans.

DM 4.5 Beginning in FY13, National and Regional data management staff will periodically investigate new tools to assist with data management and make relevant tools available to field stations.

Why is I&M doing this?

- Protocols will be stored and accessible which streamline development of IMPs, increase efficiency and reduce duplication.
- Critical natural resource information that could potentially be lost by fire, flood, theft, and other threats and will now be centrally archived on a secure system.
- Species inventories set the stage for reasoned and deliberate development of monitoring objectives and a well-designed monitoring program.

What advantages/benefits will refuges and managers see as a result of implementation?

- ServCAT is a way to preserve and ensure that refuge data is available and useable into the future.
- PRIMR can be used by a refuge to identify protocols in use for similar surveys by other stations and avoid duplication of effort.
- Standardized species nomenclature facilitates data sharing with partners.

Management Recommendations and Underlying Assumptions

- If resources are not provided to manage the data, end users will be dissatisfied with these products as the data will not be accurate or relevant.
- All stations and regions must utilize and maintain the data in these systems or they will not be useful to the Refuge System or others as the data will not be complete.
- Current I&M capacity to complete all these tasks in each region may not be feasible. Delivery of these objectives and action items depends on additional staffing to complete in a timely manner. Without staffing alignment and additional resources management may be dissatisfied with progress.

Vision for next phase (where we will go from here)

- Development of decision support tools that can utilize these data.
- Enhance relevant modules such as PRIMR to become spatially enabled.
- Document and preserve legacy biological datasets in ServCat.
- Document historical surveys in PRIMR.

Data Management - visual display of task time line											
										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
DM 1.0											
	1.1									high	low
	1.2			20%	40%	60%	80%	100%		high	medium
DM 2.0											
	2.1		50%							low	high
	2.2			100%						low	high
DM 3.0											
	3.1									low	high
	3.2					25%	50%	100%		low	high
DM 4.0											
	4.1									medium	medium
	4.2									medium	medium
	4.3									medium	medium
	4.4									high	minimal
	4.5									medium	medium
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Systems Development (SD)

Goal: Design, develop and maintain an integrated data management system that supports I&M efforts and promotes data sharing and collaboration with internal and external partners.

SD 1.0 By the end of FY14, NRPC I&M staff will deploy a database module (ServCat) that will serve as the primary repository for refuge protocols, management plans and reports.

SD 1.1 By the end of FY13, the ServCat database module is available to internal users.

SD 1.2 By the end of FY14, the ServCat data are available to external users.

SD 2.0 By the end of FY14, NRPC I&M staff will deploy a database module (PRIMR) that will serve as the primary data management system used for describing historic, current and proposed I&M survey activities.

SD 2.1 By the end of FY13, the PRIMR database module is available to internal users.

SD 2.2 By the end of FY14, the PRIMR data are available to external users.

SD 3.0 By the end of FY14, NRPC I&M staff will deploy the Water Resource Inventory and Assessment (WRIA) database module that will serve as the primary data management system used to document information about water related resources on Refuge lands.

SD 3.1 By the end of FY13, the WRIA application is integrated with ServCat.

SD 3.2 By the end of FY14, the WRIA application is available to internal users.

SD 3.3 By the end of FY14, the Water Resource Coordinator, in collaboration with Division of Environmental Quality, will identify enhancements required to integrate the Contaminant Assessment Process (CAP) database module with WRIA.

SD 4.0 By the end of FY15, NRPC I&M staff will deploy a species database module that will serve as the primary data management system used to document species occurrence on Refuge lands.

SD 4.1 By the end of FY13, define requirements; evaluate existing systems and initiate design and development of prototype.

SD 4.2 By the end of FY14, the species database module is available to internal users.

SD 4.3 By the end of FY15, the species data are available to external users.

SD 5.0 NRPC I&M staff will design, develop and deliver training for the database modules.

SD 5.1 Beginning in FY13, design and develop training materials for each database module available to internal users. This is an on-going task.

SD 5.2 Beginning in FY13, two trainings sessions are conducted annually for each database module that is available to internal users. This is an on-going task.

SD 5.3 Maintain and/or enhance training materials as needed through the end of FY18.

SD 6.0 NRPC I&M staff will maintain and enhance I&M database modules and documentation.

SD 6.1 Establish annual agreements to ensure each database module remain operable within current Service IT architecture and security controls. This is an on-going task.

SD 6.2 Evaluate user feedback and prioritize functional enhancements annually. This is an on-going task.

SD 6.3 Enhance and maintain each database module and documentation as needed through the end of FY18.

Why is I&M doing this?

- We have an obligation to make our library of refuge information easily accessible to partners and the public (unless deemed sensitive).
- Information necessary for planning and management will be readily discoverable and retrievable by Service staff.
- Establishing core database modules provide a vital foundation for many other priorities, including conducting refuge inventories, compiling monitoring data, exporting data to global data systems (e.g. Avian Knowledge Network, GBIF).

What advantages/benefits will refuges and managers see as a result of implementation?

- Less frequent data calls as many regional and national questions can be answered from an integrated information system.

Management Recommendations and Underlying Assumptions

- Training is integral component. Dedicated resources will be needed to address training requirements for properly using database modules.
- Entering and maintaining the data is more costly than developing and maintaining the system.

Vision for next phase (where we will go from here)

- Identify, develop and incorporate other database modules that can best support the I&M effort.
- Identify and integrate other relevant existing information systems or database products.

Systems Development - visual display of task time line											Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19		NRPC	Regional
SD 1.0												
	1.1										medium	minimal
	1.2										medium	minimal
SD 2.0	2.1										high	low
	2.2										high	low
SD 3.0	3.1										high	low
	3.2										high	low
	3.3										high	low
SD 4.0												
	4.1										high	low
	4.2										high	low
	4.3										high	low
SD 5.0												
	5.1										high	low
	5.2										high	low
	5.3										high	low
SD 6.0												
	6.1										medium	low
	6.2										medium	low
	6.3										high	low
Blue fill = estimated start												
Red fill = estimated completion												
Arrow = ongoing												
Values = estimated targets												
Estimated Effort is ranked as none, minimal, low, medium, high, very high												

Invasive Species Inventory and Monitoring (ISIM)

Goal: The National Wildlife Refuge System (Refuge System) has the information, resources, and technical guidance needed to assess and manage the impact of key invasive species threats or stressors on their target species and ecosystems at the local, regional, and national scales. The Service will establish and implement a coordinated, field-based, adaptive management system for invasive species across the Refuge System that incorporates early detection, inventory, and monitoring protocols using accepted metrics.

ISIM 1.0 Refuges have guidance for developing and implementing invasive species baseline monitoring protocols, also known as early detection. Refuges have regional and national support for collection and use of surveillance monitoring data by the end of FY15. The guidance will provide tools for applying survey methodologies, incorporating standard elements of early detection protocols, and assessing invasion risk to determine priority species for subsequent strategic inventory and monitoring activities.

ISIM 1.1 The Inventory & Monitoring Invasive Species Working Group (ISWG) develops the framework and outline for a Refuge System guide to invasive plant surveillance monitoring protocols by the end of FY13. The guide will incorporate Best Management Practices (BMPs) or other guidelines for prevention, current scientific recommendations, surveillance monitoring examples from the Refuge System and other land management agencies, and expert opinion.

ISIM 1.2 The ISWG will complete a Refuge System invasive plant early detection protocol guide by the end of FY15.

ISIM 1.3 The Natural Resources Program Center (NRPC) and ISWG develop a support plan for invasive plant surveillance monitoring by the end of FY16.

ISIM 2.0 ISWG and NRPC will identify and develop the tools needed to identify, document and prioritize invasive plant threats for strategic management. Priority invasive species are determined by assessing distribution, abundance, pattern, treatment feasibility, or other metrics.

ISIM 2.1 The ISWG and NRPC compiles guidelines for determining which invasive species are priority threats, in order to prioritize the collection of information (inventory, surveillance monitoring) and inform management decisions by the end of FY18.

ISIM 3.0 The NRPC completes a guide by the end of FY16 to assess the status (location, distribution, vectors, abundance, spatial scale, treatment options) of priority invasive plant threats on Refuge lands to aid in implementation of inventory activities. Invasive species status information will facilitate efficient allocation of resources for invasion management.

ISIM 3.1 Apply ISWG inventory pilot results, other case studies, and existing inventory protocols and published literature to develop a guide to conducting invasive plant inventories on Refuge lands by end of FY14. The guide will offer a framework and tools to develop inventory objectives select appropriate inventory methods, and develop inventory protocols.

ISIM 3.2 Refuges have tools to prioritize strategic management and effectiveness monitoring activities by the end of FY16.

ISIM 3.3 The ISWG/NRPC develops a plan for data management by FY16.

ISIM 3.4 As an on-going task, the ISWG will assess how predictive models (also known as habitat suitability models) can complement existing management approaches by identifying areas of current potential invasion, future invasion expansion, and highest vulnerabilities to change.

ISIM 4.0 Identify, evaluate, and utilize targeted monitoring processes to evaluate treatment effectiveness and enable Refuges to improve invasive species management outcomes by FY18. Refuges will apply adaptive management by developing objectives and monitoring management outcomes.

ISIM 4.1 By the end of FY16, the ISWG will develop pilot projects and a guide to monitor invasive plant treatment efficacy.

ISIM 4.2 The ISWG/NRPC develops a plan for data management by FY18.

Why is I&M doing this?

- The 2008 GAO report based on a survey of Refuge Managers identified invasive plant management as the largest resource management issue of the Refuge System. Understanding the status of invasive plant management on Refuges is critical; if we're winning or losing with priority invasive species threats, and if resources are being applied effectively and efficiently.
- Refuge managers need a quick, efficient and cost effective set of tools to assess the threat of new invaders and determine the effectiveness of management actions taken to treat invasive plants.
- Baseline inventories will inform development of IPM strategies and sustained monitoring will enable evaluation of IPM strategies and efficiently and effectively allocate limited invasive management resources. An effective invasive inventory and monitoring program will provide cost/benefit analysis that will help determine whether or not to conduct invasion management activities on individual Refuges.

What advantages/benefits will Refuges and Refuge Managers see as a result of implementation?

- Early detection of invasive species, inventories and effectiveness monitoring inform cost effective invasive species management. For example, development of a quick, efficient process to assess the threat of newly detected invaders, and to determine the effectiveness of rapid response management actions, will save tremendous time and money in long-term management.
- A prioritization process for guiding overall invasive plant inventory efforts will enable Refuge Managers to carry out inventories that help them conduct more effective treatments, including eradication, control, or containment efforts.

Management Recommendations and Underlying Assumptions

- Emphasize early detection to minimize the introduction and spread of invasive species on Refuges.
- Protocols developed for invasive plant management can be applied to all-taxa efforts in future planning.
- A rapid assessment approach is needed with consistent metrics and a method to prioritize highest-risk species that can be applied across every Refuge a comprehensive inventory of all invasive species across the Refuge System is not feasible.
- In general, invasive plant species are a threat to habitat and ecosystem health, and if not addressed, the dynamic nature of a changing climate will intensify this threat in many cases. However, it is recognized that not all non-native plants are invasive and some species may actually provide benefits to ecosystem health.

- If mapping and threat prioritization is not conducted we risk wasting time and resources on ineffective or lower payoff action.

Vision for next 5 - 7 years

- Implement surveillance monitoring processes with a prioritized inventory and monitoring plan for invasive species in select Refuges.
- Complete a guide for conducting invasive plant inventories and monitoring on refuges based on the prioritization process developed by the pilot invasive species inventory project.
- Develop treatment efficacy monitoring processes for Refuges.

Invasive Species Inventory and Monitoring (ISIM) - visual display of task time line												
											Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19		NRPC	Regional
ISIM 1.0												
	1.1										medium	low
	1.2										medium	medium
	1.3										medium	medium
ISIM 2.0												
	2.1										medium	low
ISIM 3.0	3.1										medium	low
	3.2										medium	low
	3.3										medium	low
	3.4										medium	low
ISIM 4.0	4.1										medium	low
	4.2										medium	low
Red fill = estimated completion												
Arrow = ongoing												
Values = estimated targets												
Estimated Effort is ranked as none, minimal, low, medium, high, very high												

Endangered Species Act Reporting (ESAR)

Goal: Provide information on the status and monitoring of species classified under the Endangered Species Act (ESA) in the Refuge System.

ESAR 1.0 Develop a definitive list for each refuge of the species classified under the Endangered Species Act that occur, or according to historic ranges, could have occurred on the refuge by the end of FY15.

ESAR 1.1 By end of FY12, provide a process to establish a list of current, historic, and restored ESA species for each refuge to validate.

ESAR 1.2 By end of FY13, refuges will validate the established list of current, historic and restored ESA species for their refuge and identify if the species is currently being monitored.

ESAR 1.3 By end of FY15, and at least every five years thereafter, each refuge with ESA species will validate status of species and confirm whether they are being monitored.

ESAR 2.0 Determine which ESA species that occur and are not monitored on the Refuge System, and select some to initiate cooperative monitoring by the end of FY19.

ESAR 2.1 By the end of FY13, refuges will report which ESA listed species are currently being monitored.

ESAR 2.2 By the end of FY15, at least one I&M staff will be assigned to work with refuge staff and collaborate with ES recovery team leads to identify a species not currently being monitored to serve as a pilot for integrated monitoring on a refuge in each region.

ESAR 2.3 By FY19, in collaboration with ES, initiate an integrated monitoring program of ESA species on refuges that includes outreach to refuge supporters and partners.

Why is I&M doing this?

- As one of the two regulatory agencies of the Endangered Species Act, it is important that we know which ESA species currently occur on refuges and which refuges are within the historic range of federally listed species.
- We need to know which of the ESA species that refuges are currently monitoring, and the priority of these surveys as Inventory and Monitoring Plans are developed.
- The Threatened and Endangered Species System of ECOS should have reliable data from the National Wildlife Refuges on the presence ESA species, and it is the responsibility of our program to assure the accuracy of this information.
- To ensure coordination among Service Programs (ES and Refuges) to provide the best and most accurate information available.
- Improve cross-programmatic information within Service Programs.

What advantages/benefits will refuges and managers see as a result of implementation?

- Refuge staff will be able to say which ESA species are on the refuge and which could have been there, historically.
- We have established the list of federally listed species that could be expanded to state-listed species, surrogate species, and other significant species, if Service thinks that is warranted.

- Gives the Project Leaders the information needed to manage for sensitive species in a potentially changing environment.

Management Recommendations and Underlying Assumptions

- Requires close and frequent coordination with Endangered Species staff, which may require additional travel.
- Potential for mission creep. Will it be I&M (and refuge's) role to become the monitoring arm of ES (i.e., conduct integrated monitoring of T&E across refuges).

Vision for next phase (where we will go from here)

- After there is a cross-programmatic consensus list of ESA species, roll up the data to provide a comprehensive view of these species on refuges.
- Identify information gaps for ESA species, identify and prioritize needed monitoring, and implement high priority monitoring.
- Work with ES to examine restoration opportunities, or population augmentation to aid in recovery efforts or to prevent candidate from being listed.
- Identify which state listed species occur on refuges and how we could work with state wildlife agencies to identify the refuge role in monitoring and recovery.

Endangered Species Act Reporting - visual display of task time line											
										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
ESAR 1.0											
	1.1									high	medium
	1.2									medium	high
	1.3									minimal	low
ESAR 2.0											
	2.1									medium	low
	2.2									low	medium
	2.3									medium	medium
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Vegetation Mapping (VM)

Goal: Provide summaries of vegetation resources on Refuge lands and ensure each refuge has the capacity to efficiently acquire vegetative covers datasets that meet their specific needs.

VM 1.0 By the end of FY13, NRPC I&M staff will provide national and regional summaries of vegetation resources on Refuge lands using existing national vegetation datasets.

VM1.1 By the end of FY13, develop regional and national summaries of vegetation resources on Refuge lands using existing national datasets.

VM 1.2 By the end of FY13, NRPC I&M staff ensures the datasets and summary reports are accessible to internal users via the ServCat application.

VM2.0 By the end of FY15, in collaboration with the Geospatial Advisory Committee, the I&M Vegetation Team will develop guidance for contracting, acquiring, or developing vegetative cover datasets.

VM2.1 By the end of FY14, identify appropriate classification systems and geospatial data standards to be used when contracting, acquiring, or developing vegetative cover datasets.

VM2.2 By the end of FY15, produce guidance document to facilitate consistency in the acquisition and development of vegetative cover datasets on Refuge lands.

Why is I&M doing this?

- Establishing baseline vegetative cover mapping will allow us to conduct change detection analyses for monitoring and quantifying shifts in vegetation communities.
- To provide national and regional area summaries of vegetative resources on Refuge lands.
- To improve efficiencies in contracting the acquisition of vegetative cover spatial datasets.
- Vegetative cover datasets are a crucial component for developing species habitat models.

What advantages/benefits will refuges and managers see as a result of implementation?

- The inventory of these resources help refuge managers conserve plant biodiversity, manage challenges such as exotic species, urbanization, insect outbreaks and diseases, and understand resources and processes such as wildlife-habitat relationships and wildland fires.
- Comprehensive vegetative cover maps of refuge landscapes and surrounding areas will allow refuge manager to identify suitable sites for restoration and acquisition in order to facilitate the establishment of extensive protected areas connected by biological corridors.
- Guidance documents will allow staff to be more efficient when acquiring and/or developing vegetation datasets.

Management Recommendations and Underlying Assumptions

- Refuge staff must articulate their requirements to ensure an appropriate scale and quality of the spatial data is acquired or developed.
- Creating a standard product for every refuge is not feasible due to the varying spatial extent and needs of individual refuges.
- Development of geospatial data for vegetation is costly. Collaboration with planning staff will be necessary to prioritize acquisition and leverage resources.

Vision for next phase (where we will go from here)

- Develop national framework for monitoring vegetation consistently across our network of lands.
- Identify and evaluate existing national systems for storing vegetation monitoring data.
- Develop species habitat models (maps) for priority species.

Vegetation Mapping - visual display of task time line												
											Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19		NRPC	Regional
VM 1.0												
	1.1										high	low
	1.2										medium	low
VM 2.0												
	2.1										low	low
	2.2										high	low
Blue fill = estimated start												
Red fill = estimated completion												
Arrow = ongoing												
Values = estimated targets												
Estimated Effort is ranked as none, minimal, low, medium, high, very high												

Abiotic Data (AD)

Goal: Ensure each refuge has the capacity to utilize core abiotic base data layers in order to inform management decisions on Refuge lands.

AD 1.0 By the end of FY13, provide all field stations with a process to acquire existing core abiotic datasets such as topography, aerial photography, hydrography, soils, boundaries and infrastructure.

AD 1.1 By the end of FY13, NRPC I&M staff provides instructions to I&M Staff, field stations and planners how to acquire these datasets independently.

AD 1.2 By the end of FY13, NRPC I&M staff develops process to deliver these datasets to refuge field stations that do not have the capacity to acquire independently.

AD 2.0 By the end of FY14, I&M staff in collaboration with the Geospatial Advisory Committee (GAC), identify additional abiotic data layers relevant to field stations and/or ecological planning that do not exist and develop a schedule for developing and/or acquiring.

AD 2.1 By end FY13, identify and prioritize additional abiotic data layers relevant to field stations and/or ecological planning that do not exist.

AD 2.2 By the end of FY14, estimate costs for developing and/or acquiring additional abiotic data layers relevant to field stations and/or ecological planning that do not exist.

AD 2.3 By the end of FY14, develop schedule for developing and/or acquiring these data.

AD 3.0 By the end of FY18, I&M staff assists with the collection and maintenance at least two refuge specific abiotic datasets identified by the GAC as nationally significant to fulfill programmatic needs.

AD 3.1 By the end of FY14, assist with the development of geospatial data standards for at least at least two refuge specific abiotic datasets identified by the GAC as nationally significant to fulfill programmatic needs.

AD 3.2 By the end of FY15, assist with the development of workflows for collecting and reviewing at least two refuge specific abiotic datasets identified by the GAC as nationally significant to fulfill programmatic needs.

AD 3.3 By the end of FY18, assist with the collection and maintenance of at least two refuge specific abiotic datasets identified by the GAC as nationally significant to fulfill programmatic needs.

Why is I&M doing this?

- To fulfill the recommendations of Promise Team (WH 8.1).
- To provide baseline data that will inform ecological planning, refuge management, biotic or on the ground abiotic inventories, and monitoring.
- Abiotic and biotic information on refuges is the foundation of refuge planning and management.

What advantages/benefits will refuges and managers see as a result of implementation?

- Refuges without the capacity to acquire these data independently or those stations with limited bandwidth can request these data via I&M Data Managers.

Management Recommendations and Underlying Assumptions

- The Promise Team recommendations provided in WH8.1 are outdated. The Refuge System Geospatial Advisory Committee (GAC) is actively working to identify, prioritize, develop and/or acquire refuge specific GIS abiotic and biotic base datasets that will supersede WH8.1.
- The Geospatial Advisory Committee (GAC) is actively developing strategies and data standards to facilitate the development of refuge specific abiotic datasets such as water related infrastructure and public use boundaries (hunting zones).
- Significant resources will be required to acquire refuge specific abiotic data not currently available. Therefore, we need to ensure that regions hire zone data managers as identified in the national staffing structure plan. Without additional assistance, these objectives will not progress as planned.
- Training of refuge personnel will be required so they have the necessary skills to interpret and analyse these data in order to inform management decisions on Refuge lands.

Vision for next phase (where we will go from here)

- Refine the workflows to acquire, maintain and make available to others refuge specific abiotic data layers that are identified by the Geospatial Advisory Committee as nationally significant to fulfill programmatic needs.

Abiotic - visual display of task time line												
											Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19		NRPC	Regional
AB 1.0												
	1.1										low	low
	1.2										low	low
AB 2.0												
	2.1										low	low
	2.2										medium	low
	2.3										medium	low
AB 3.0												
	3.1										medium	medium
	3.2										medium	medium
	3.3										high	very high
Blue fill = estimated start												
Red fill = estimated completion												
Arrow = ongoing												
Values = estimated targets												
Estimated Effort is ranked as none, minimal, low, medium, high, very high												

Bird Inventory and Monitoring (BIM)

Goal: Ensure that bird inventory and monitoring surveys on refuge lands are scientifically credible, evaluate refuge contributions to local, regional, landscape, flyway, and continental scale bird population objectives, and are coordinated across the landscape with other Service programs and our partners. The data will be used to assess the size, distribution, and status of bird populations and to gauge the success of management and conservation efforts. There will be general coordination for each task with Data Management (DM) focal area.

BIM 1.0 Beginning in FY13 and continuing through FY19, and in collaboration with Migratory Birds, the Joint Ventures, and the LCC's, develop and initiate a strategy to integrate, standardize (where appropriate), and coordinate bird monitoring across the nation.

BIM 1.1 Beginning in FY12, establish a Refuge System Bird Monitoring Team (Bird Team) and associated Work Groups that include internal and external partners to focus on specific bird inventory or monitoring issues. The team's primary charge is to support inventories, monitoring and evaluation of refuge contributions to migratory bird population objectives set by Service Migratory Birds, stepped down to smaller geographic units by flyway councils, Joint Ventures and LCC's. The Bird Team will meet monthly.

BIM 1.2 By the end of FY14, the Bird Team will use PRIMR to identify avian inventory and monitoring needs common to multiple refuge stations or regions and identify potential gaps in inventories or monitoring.

BIM 1.3 Beginning in FY13 and continuing through FY15, the Bird Team will identify and prioritize bird monitoring objectives across the Refuge System to ensure that bird monitoring contributes to landscape level plans (e.g. JVs, LCC and other partnerships).

BIM 1.4 By FY14, the Bird Team will develop a strategy to assist in the selection and monitoring of surrogate bird species. This task will require coordination with Surrogate Species Monitoring Objective 1.0.

BIM 2.0 Beginning in FY13 and continuing through FY19, develop processes to produce national and/or regional bird monitoring protocol frameworks for the Refuge System. This includes the development of protocols per the I&M policy and the Protocol Development Handbook. This may involve coordination with the *Vegetation Mapping (VM)* focal area.

BIM 2.1 Beginning in FY13 and continuing through FY16, the Bird Team will identify and evaluate the utility of protocols and data management systems provided by other agencies and organizations (e.g., NPS, Point Reyes Bird Observatory, Rocky Mountain Bird Observatory, etc.) for Refuge System applications.

BIM 2.2 Beginning in FY13 and continuing through FY15, the Bird Team will work with Migratory Birds to support a national protocol framework, data management system, training, and reporting focused on *point counts for breeding marshbirds*. This task requires coordination with the I&M Planning Objective 3.0.

BIM 2.3 Beginning in FY13 and continuing through FY15, the Bird Team will work with Migratory Birds and other Partners to support one or more national protocol frameworks, a data management system, training, and reporting focused on *point counts for breeding land birds*. This task requires coordination with the I&M Planning Objective 3.0.

BIM 2.4 Beginning in FY13 and continuing through FY16, the Bird Team will work with Migratory Birds and the Integrated Waterbird Management and Monitoring (IWMM) project to

promote and support a national protocol framework, data management system, training, and reporting focused on monitoring *migrating and wintering waterbirds* in Regions 3, 4, and 5.

BIM 2.5 By FY16, the Bird Team will identify, prioritize, and develop an *implementation strategy* to produce the national and/or regional protocol frameworks needed to inventory or monitor forest, grassland, shrubland and other birds as appropriate.

BIM 2.6 Beginning in FY14 and continuing through FY17, the Bird Team will make a recommendation regarding the feasibility of unifying migrating and wintering waterbird monitoring and management among the flyways and with partners across the Refuge System.

BIM 3.0 Beginning in FY13 and continuing through FY18, the Bird Team and the I&M Data Manager Team will develop processes for ensuring that bird data generated from specific monitoring protocol frameworks meet quality assurance requirements, data are periodically uploaded into AKN as a final repository, and that data sharing agreements are in place with all parties collecting bird data on refuges. The data sharing agreements will require coordination with the *Data Management (DM)* focal area.

BIM 3.1 By the end of FY14, a contractor will review and engage in quality assurance procedures for Refuge System landbird data that reside in the USGS National Point Count Database in preparation for transfer to AKN. Evaluate whether a similar process is needed for Refuge System marshbird data that currently reside in the USGS Marshbird Database.

BIM 3.2 Beginning in FY16 and continuing through FY18, the Bird Team will develop processes for data management for forest, grassland, shrubland and other birds as appropriate.

BIM 3.3 By the end of FY13, convene a meeting with partners to develop a unified approach to data management for bird data collected by the Refuge System and other land management partners. Explore interest by the North American Bird Conservation Initiative (NABCI) Monitoring Sub-committee in co-hosting this meeting.

BIM 4.0 By the end of FY15, identify and address, as appropriate, training needs associated with commonly used bird inventory and monitoring protocols.

BIM 4.1 By the end of FY14, the Bird Team will identify existing bird-associated training provided by other Service programs, agencies and organizations (e.g., NPS, Point Reyes Bird Observatory, Rocky Mountain Bird Observatory, etc.) with potential application by the Refuge System and develop systems for tapping into these resources.

BIM 4.2 Beginning in FY14 and continuing through FY15, develop strategies for developing and hosting trainings that support bird monitoring objectives. This will require close coordination with the Service National Conservation Training Center (NCTC).

Why is I&M doing this?

- The National Wildlife System (Refuge System) has legal and stewardship responsibilities to sustain birds and their habitats across the nation, in cooperation with Migratory Birds. The Refuge System has a legal mandate to monitor the status and trends of wildlife populations on refuges and collect and manage information needed to maintain biological integrity, biological diversity, and environmental health.
- Bird monitoring conducted by refuges in the past was often not coordinated among refuges or with partners; data summaries and analyses were inadequate to inform management and did not link clearly to larger scale conservation objectives identified by Service Migratory Birds or other regulatory agencies (states).
- The Refuge System has a major role, in cooperation with the Migratory Birds, to design and implement nationally coordinated, scientifically credible inventories and monitoring to assess the

status of populations, the quality of bird habitat, and to evaluate the effectiveness of management at multiple spatial scales.

- The Refuge System must develop strategies for collaborating with partners and sharing bird data with the larger conservation community. The Refuge System must ensure that refuge bird monitoring contributes to refuge, regional and continental scale population objectives (goals).
- Many bird species will be selected as surrogate species; monitoring the population status of these species and the species they are intended to benefit, will be a high priority for the Service.

What advantages/benefits will refuges and managers see as a result of implementation?

- Implementation of Refuge System conservation actions within an adaptive framework at either the individual refuge level or as a part of coordinated regional efforts will help ensure that monitoring supports management and promotes improved management over time through learning at all spatial scales. Monitoring should reduce management uncertainty, including uncertainties exacerbated by climate change.

Management Recommendations and Underlying Assumptions

- Since many bird surveys will be coordinated with partners (e.g., Migratory Birds, Joint Ventures, Flyways, Bird Observatories, etc.), the tasks and timetables cannot be set solely by I&M and will depend on cooperation among the parties involved.
- Bird Team input on surrogate species selection will depend on the process and timeframe of the of the Service surrogate species initiative.

Vision for next phase (where we will go from here)

- Bird monitoring conducted by the Refuge System will be coordinated among refuges and with partners and have a clear connection to larger scale conservation objectives identified by Service Migratory Birds or other regulatory agencies (states). Surveys will use approved protocols that are scientifically rigorous. Data sets are of high quality, accessible, and preserved for the long-term. Databases are user-friendly, result in timely reporting, and support management decision making at multiple spatial scales.

Bird Inventory and Monitoring - visual display of task time line											
										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
BIM 1.0											
	1.1	■	→							low	medium
	1.2		■	■						low	medium
	1.3		■	→	■					medium	high
	1.4		■	■						high	medium
BIM 2.0											
	2.1		■	→	→	■				high	high
	2.2		■	→	■					high	medium
	2.3		■	→	■					high	high
	2.4		■	→	→	■				low	high
	2.5		■	→	→	■				high	high
	2.6			■	→	→	■			medium	high
BIM 3.0											
	3.1	■	→	■						low	low
	3.2					■	→	■		low	medium
	3.3	■	■							medium	low
BIM 4.0											
	4.1		■	■						low	low
	4.2			■	■					low	low
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Baseline Biotic Inventories (BBI)

Goal: Create a credible species list for the Refuge System that is accessible, updatable, and expandable by the end of FY18.

BBI 1.0 Compile and verify existing observations of species on Refuge System lands.

BBI 1.1 By the end of FY13, an Inventories Team will identify, evaluate and prioritize the sources of existing species observation data that can be used to pre-populate a data information system for species observations. This task will require consultation and coordination with partners that have observation data (e.g., eBird).

BBI 1.2 By the end of FY13, the Inventories Team will identify sources for populating the data information system with bird occurrence data and identify what steps can be completed while the data information system is being developed. This task requires coordination with Data Management Objective 3.0 and System Development Objective 4.0.

BBI 1.3 By end of FY14, create a bird list for each station using the species observation data from BBI 1.1 (Data Management Objective 3.0) in preparation for validation. The Species Inventory team will need to work in collaboration with the Bird Team to complete this task.

BBI 1.4 By end of FY14, the NRPC I&M staff will populate a beta species information system with the preliminary bird lists in preparation for validation by the refuges.

BBI 1.5 By the end of FY15, The Inventories Team will recommend guidelines for when taxonomic experts are needed to assist with validation of the species lists.

BBI 1.6 By the end of FY15, the Species Inventory team will implement a process to input the remaining taxa into the species data information system.

BBI 2.0 Identify and catalogue all refuges that have conducted scientifically defensible baseline inventories, document the target taxa, and conduct a gap analysis to determine what baseline inventories are needed by the end of FY17.

BBI 2.1 By the end of FY14, the NRPC I&M staff will use PRIMR and ServCat to create a straw-man list of baseline inventories conducted on Service lands.

BBI 2.2 By the end of FY15, the I&M Team will validate the list created in BBI 2.1.

BBI 2.3 By the end of FY17, the I&M Team will complete a gap analysis and create a prioritized list of baseline inventories to be conducted, along with a recommended time line for implementation. This task will include recommendations on the level of needed to conduct the inventories.

BBI 3.0 Conduct needed baseline inventories of vertebrates, vascular plants, and a subset of invertebrates on refuge lands in FY18.

BBI 3.1 By the end of FY18, begin conducted the identified needed inventories in coordination with station IMP priorities.

Why is I&M doing this?

- Management at all organization levels need an easy way to produce scientifically defensible lists of species that currently occur on Service lands.

- Clear baseline understandings are vital to assessing change and developing management strategies. Having consistent, centralized species lists will expedite development of local and regional database development to support the field.
- Species occurrence data allow managers to keep track of changes in species composition on refuges over the years. These data are the foundation for population inventories and species monitoring, which are increasingly important for informing adaptive management in the face of environmental stressors.
- We will use species occurrence data to assist in prioritizing which biotic inventories need to be conducted on refuges.
- Having species occurrence data in an easily accessible system with strong data standards will allow us to share information with the global biology community.

What advantages/benefits will refuges and managers see as a result of implementation?

- Refuge staff will be able to easily produce scientifically defensible lists of species that currently occur at their refuge to meet many needs, such as bird lists for visitors.
- Analysis of current and historic species occurrence will help managers prioritize and alter management actions.
- Species occurrence information will be used to inform what inventories should be conducted, assist in developing future inventory and monitoring surveys, and assist biological planning.

Management Recommendations and Underlying Assumptions

- It is important that the refuge users can easily access and suggest additions to the list as the species occurrence information system will need to be verified and updated on a regular basis.
- Improved field connectivity to centralized systems is needed.
- Data information systems require long-term maintenance and up-grades to maintain their value. This total cost is not trivial and often is greater than the initial investment in development.

Vision for next phase (where we will go from here)

- Implementation of baseline inventories.

Baseline Biotic Inventories - visual display of task time line											
										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
BBI 1.0											
	1.1									minimal	low
	1.2									low	low
	1.3									minimal	minimal
	1.4									medium	minimal
	1.5									low	medium
	1.6									minimal	minimal
BBI 2.0											
	2.1									low	none
	2.2									minimal	medium
	2.3									low	low
BBI 3.0											
	3.1									minimal	low
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Phenological Monitoring (PM)

Goal: Ensure that phenological monitoring conducted on refuge land is scientifically credible and will be used to inform climate related management questions at multiple spatial and temporal scales.

PM 1.0 Provide a recommendation on how phenological information collected on refuge lands can be used to inform management actions and forecast climate change related effects.

PM 1.1 By December 31, 2012 I&M will have analysed the results from the survey of refuge phenology monitoring to determine the following: what phenological data is being collected, what percentage of phenological data is being collected by citizens, has the data been analyzed, where is the data being stored, and has it been used to guide management activities

PM 1.2. By the end of FY13, fully implement the Service landing page on the NPN website to provide refuge specific information regarding phenological monitoring for refuge staff and provide an avenue to integrate "citizen scientists" with refuge monitoring.

PM 1.3 Through FY13, work with refuges to develop data management tools (input and out) that meet refuge needs for data entry, export, and summary statistics. Note – this will be an ongoing task that will require regional and national attention.

PM 1.4 By end of FY15, the I&M team will create a list of appropriate field level phenological measures that should form the basis of any phenology monitoring effort and will have assessed which protocols currently meet the minimum standards as delineated in the Service Survey Protocol Handbook.

PM 1.5 By FY17, in collaboration with NPS and other partners, evaluate phenological data collected on refuges for contributions to regional and larger scale analyses.

Why is I&M doing this?

- Phenological data can inform when changes in management actions and planning should be considered in light of climate related shifts in ecosystem functions.
- Collection and analysis of phenological data provides information on potential changes in key biological events and the resulting impact on ecosystem dynamics.
- Ensure that Refuge System is a key contributor to a larger effort, providing data that will inform climate related management questions at multiple scales.
- "Citizen scientists" could help build awareness and public support for refuges and monitoring activities.
- Refuge data informs larger phenological analyses at a landscape scale.
- Provide data that will inform climate related management questions at multiple scales

What advantages/benefits will refuges and managers see as a result of implementation?

- Refuges get ready access to established protocols and a centralized data information system for phenological data
- Provides information to adjust management actions.
- Refuges will have tools for easy input and output of phenological data

Management Recommendations and Underlying Assumptions

- Analysis and interpretation of phenology data is complex. It may be very difficult to make sense of this information without a tight research framework.

Vision for next phase (where we will go from here)

- Landscape level monitoring of phenology via satellite can inform broad-scale changes in seasonal events and provides information for remote areas with limited access. However, ground data are needed to ‘calibrate’ remotely sensed data. Determine the field data necessary to improve the accuracy of satellite imagery in monitoring phenological events.

Phenological Monitoring (PM)										
Phenological Monitoring - visual display of task time line										
										Estimated Effort
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC Regional
PM 1.0										
	1.1									minimal minimal
	1.2									minimal minimal
	1.3									low minimal
	1.4									low minimal
	1.5									low medium
Blue fill = estimated start										
Red fill = estimated completion										
Arrow = ongoing										
Values = estimated targets										
Estimated Effort is ranked as none, minimal, low, medium, high, very high										

Adaptive Management (AM)

Goal: To promote understanding of the adaptive management (AM) process and the implementation of AM at multiple spatial scales.

AM 1.0 Provide each refuge with access to the necessary resources to fully implement the principles of adaptive management (AM) by the end of FY19.

AM 1.1 In FY13 the I&M Initiative will establish an AM Team that is charged to work with the Refuge System Science Excellence Implementation Team (convened after the Refuge System Vision Conference), the Natural Resources Leadership Team, and others with expertise in AM to provide leadership and assess the need for AM tools and resources across the Refuge System. The AM Team will keep the I&M Coordination Team informed of emerging needs and recommendations for action or support.

AM 1.2 From FY13-FY14, the I&M Team will work with the Refuge System Science Excellence Implementation Team to produce a white paper that defines different levels of AM as practiced in the Refuge System and identifies the fundamental technical skills, tools, resources, and training needed to support monitoring under an AM framework, with recommendations for future actions. The I&M Team will work with the Refuge System Science Excellence Implementation Team to find ways to implement the recommendations regarding AM put forward by this team.

AM 1.3 From FY13-FY14, the I&M Initiative will identify and support existing and new AM projects ongoing across the Refuge System, help them be successful, explore possible metrics for tracking achievement of management objectives, explore ways of reporting accomplishments to different audiences, and seek to learn as much as possible from their experiences.

AM 1.4 Beginning in FY14, the Annual Report/Work Plan will summarize the existing regional and multi-regional AM projects, tools, and software, and lessons learned. The I&M Initiative will prepare a summary of the AM toolbox and provide case studies and metrics illustrating accomplishments for the FY14 State of the Refuge Report.

AM 1.5 By end of FY14, Region 1 will make available the Refuge Habitat Management Database (RHMD) as an AM tool for field stations and provide recommendations and resources for ongoing training and use of the Database by refuge stations.

AM 1.6 From FY15-FY16, the I&M Team will work with the Refuge System Natural Resources Leadership Team to conduct a multi-regional needs assessment to identify the most pressing resource management issues across the Refuge System. We will summarize these in a white paper and identify the most useful approaches for addressing the issues, including AM approaches.

AM 1.7 From FY17-FY18, in cooperation with the Refuge System Natural Resources Leadership Team, the I&M Team will provide leadership to devise and implement strategies for addressing the issues identified in AM 1.6, building upon the learning gleaned from past AM projects (AM 1.3).

AM 1.8 Beginning in FY13 and continuing through FY19, I&M staff will be engaged in all aspects of this task, including supporting ongoing SDM and AM training needs, in cooperation with the Natural Resources Leadership Team, the National Conservation Training Center, USGS, and other appropriate collaborators.

Why is I&M we doing this?

- AM is an appropriate focus of the Refuge System I&M Initiative because a large proportion of the monitoring conducted by refuge stations, with the possible exception of those in Alaska, is

directed towards evaluating the effectiveness of management. We simply need to know if we are meeting our management objectives as set out in our CCP's and HMP's, and if we are not, we must learn as rapidly as possible from our experiences. For example, little progress can be made against invasive species, among of our most pressing and pervasive management problems, without AM. The management tools that keep invasive species in check, (herbicides, bio-controls) developed in laboratories and greenhouses under controlled conditions, must ultimately be tested and proven effective under a wide range of field situations when applied by many different managers. AM is specifically designed to foster rapid learning and better decisions on the ground.

- Documentation of past management actions and the ecosystem / habitat responses to those actions is lacking on many national wildlife refuges and units managed by our partners (states). This makes it difficult for our managers to use past management actions to inform their current decisions (learn), especially given the extended time frames associated with ecosystem restoration and a high incidence of staff turnover at field stations. The outcomes of a management decision may take decades to fully manifest (species introductions, timber stand improvement), often longer than any single manager's tenure! A basic level of documentation and institutional memory is necessary for even the simplest form of AM and is a prerequisite for sharing information across multiple stations or agencies. The Refuge System has several options available to stations for recording this information. The first step in applying AM more widely on refuges is to increase awareness about what AM tools are currently available to resource managers and how to use them.
- The threat of climate change, in addition to a host of other stressors (rapid urbanization, intensification of agriculture, invasive species, and oil, gas, and wind development, etc.) are challenging the capacity of our managers to make good decisions in the face of uncertainty. We and our land management partners don't have the luxury of learning slowly what works and what doesn't by simple trial and error as we have in the past. Most monitoring currently ongoing on refuges was not designed to maximize learning. Opportunities for conservation success and shared learning are quickly being lost.
- The common denominator of all forms of AM is monitoring; a national plan is needed to coordinate regional AM efforts, promote shared learning, and avoid duplication of effort. The Service Climate Change Strategic Plan was developed in response to the above issues. AM is a key tool needed by the LCC's to address many of these threats and uncertainties on the ground. The AM toolbox can also help integrate refuge biology with other Service programs (Ecological Services, Fire, Invasive Species, DEQ, Water Resources, and Planning).
- The scientific literature on AM is both very large and confusing. There are different schools of thought regarding what AM is and how it should be applied. The Refuge System must sort through this literature and adopt the theory and tools that are most appropriate, feasible, and effective for meeting the Service and Refuge System Mission. Through training, technical support, and collaboration with our science partners (USGS, Coop Units, universities), I&M can help translate the guidance found in the Department of the Interior's Technical and Applications Guides for purposes of planning management and monitoring that will advance the Service's Mission across the landscape.

What advantages/benefits will refuges and managers see as a result of implementation?

- AM helps speed the process of 'learning by doing'. Monitoring under an AM framework has direct and immediate relevance to management.
- AM marries management with monitoring, thus improving the quality and effectiveness of resource management.

- AM will improve the quality of documentation of both management actions and ecosystem responses and provide a more robust set of legacy data to support current and future management.
- AM provides a means for gaining knowledge through cooperation and cost-sharing with other agencies that have similar needs; the LCC's are in a key position to support AM at a landscape scales.
- AM will support a hands-on land management approach and promote the landscape scale conservation successes articulated within the System Mission and the Service Climate Change Strategic Plan.
- AM will enhance and support biological capacity of refuge staffs (refer to Biological Needs Assessment).

Management Recommendations and Underlying Assumptions

- The Mission of the Refuge System is "...to administer a network of lands and waters for the conservation, management, and, where appropriate, restoration of fish, wildlife, plants, and their habitats..." Our mission statement recognizes the need to implement management actions, as necessary, to achieve resource management objectives on units of the Refuge System. In accordance with DOI's 522 DM 1 (AM Implementation policy), refuges staffs shall utilize AM for conserving, protecting, and, where appropriate, restoring refuge lands and resources. Specifically, an AM approach marries management with monitoring to determine resource status, promote learning, and evaluate progress toward achieving objectives. AM provides a structured process to consistently derive effective decisions that increase scientific knowledge while reducing tensions among stakeholders' (522 DM 1.3).
- A key assumption for AM is that complete knowledge about fish, wildlife, plants, habitats, and the ecological processes supporting them is often lacking. The role of natural variability contributing to ecological resilience is recognized as an important AM principle. The recently published DOI AM Technical Guide defines AM as a process that "promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood".
- AM is most useful when managers can select among a set of alternative management or policy decisions, there is uncertainty surrounding the outcomes of management decisions, and enough staff time and resources are available to plan, implement, and monitor the outcomes of decision making. If only one management alternative is available, or there is no uncertainty about outcomes, or resources are so limited that monitoring is not feasible, then alternative approaches to decision making are indicated.
- Different levels of AM are needed to match the level of uncertainty or magnitude of risk if the wrong decision is made with cost and effort. The simplest form of AM involves consideration of alternative management strategies, implementing the decision and monitoring, with feedback to the next similar decision. This differs from trial and error in that several management alternatives were carefully considered and one was selected, perhaps through the use of a simple consequence table. Model-based forms of AM are more complex, but also more structured and robust and can be employed for problems shared by multiple refuges or land management agencies. Model-based forms of AM generally entail more time and expense and require technical support by those with expertise in modeling, AM, and database design and management. In general, strong technical consultation and support will be needed to implement model-based AM. At the present time, the Service has a deficit of technical staff with specialized expertise to meet the needs; this is also a problem for many of our land management partners.

- The roles of the regions and the Natural Resources Program Center in supporting AM will need to be defined. There is a close tie between protocol frameworks and their use in AM.

Vision for next phase (where we will go from here)

- All refuges will have access to the expertise, tools, and resources to implement AM, when it is indicated. We will use AM, in partnership with others, to improve management over time through learning, meet the Service Mission, and achieve conservation success on the ground. AM leads to rigor in documenting management decisions and associated ecosystem responses. Accomplishments are recorded and useful metrics are derived that track ecosystem changes over time.
- Establish a DOI Adaptive Management Help Center that coordinates the development and deployment of tools, resources, and consultants to help land managers implement AM, when it is appropriate.

Adaptive Management - visual display of task time line										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
AM 1.0											
	1.1		Blue fill	Blue arrow						minimal	medium
	1.2		Blue fill	Red fill						none	medium
	1.3		Blue fill	Red fill						medium	medium
	1.4			Blue fill	Blue arrow					minimal	minimal
	1.5		Blue fill	Red fill						none	low
	1.6				Blue fill	Red fill				minimal	medium
	1.7						Blue fill	Red fill		minimal	medium
	1.8		Blue fill	Blue arrow						low	medium
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Wilderness Character Monitoring (WCM)

Goal: To assess the baseline quality of wilderness character on all designated wilderness within the Refuge System and then monitor trends in wilderness character over time using a nationally consistent approach.

WCM 1.0 Develop, assess and quantify measures of wilderness character on all refuges with designated or proposed wilderness as stated in the Wilderness Act by the end of FY16.

WMC 1.1 By the end of FY14, utilize Wilderness Fellows and trained refuge staff to develop a baseline of wilderness character measures for each refuge with designated wilderness.

WMC 1.2 By the end of FY15, work with the Wilderness Character Monitoring team to develop a strategy to encourage participation of all refuges with designated wilderness in wilderness character monitoring using the guidelines developed by the interagency effort "Keeping it Wild."

WCM 1.3 By end of FY16, NRPC I&M staff and the Wilderness Character Monitoring team will evaluate the completed individual refuge reports to determine their utility to address requirements for wilderness inventory processes under the Wilderness Act.

WCM 1.4 By the end of FY16, NRPC I&M staff and the Wilderness Character Monitoring team will develop and provide common training on wilderness character and the development of wilderness character measures across the four agencies with designated wilderness.

WCM 2.0 Develop long-term monitoring protocols for wilderness character on refuges

WMC 2.1 By end of FY16, the I&M Team will evaluate whether wilderness character monitoring is represented in the Inventory and Monitoring Plans for refuges with wilderness. This task will be coordinated with I&M Planning Objective 1.0.

WMC 2.2 By the end of FY18, the NRPC I&M staff and the Wilderness Character Monitoring team will work with Carhart National Wilderness Training Center and the National Conservation Training Center to develop training for long-term wilderness character monitoring.

Why is I&M doing this?

- To meet our responsibility of the Refuge System to preserve wilderness character under the Wilderness Act.
- Wilderness areas can serve as reference areas to be compared with similar ecosystems undergoing active management to help us monitor climate change.
- To establish a baseline of wilderness characteristics for the 65 designated wilderness areas in the Refuge System.

What advantages/benefits will refuges and managers see as a result of implementation?

- Wilderness areas are often the least utilized and therefore the lower priority areas of refuges. Establishing this baseline and committing to monitoring gives managers a better handle of the important aspects of this part of the refuge.
- It is an opportunity to do training and monitoring with other land management agencies, and to compare the measures by which we evaluate wilderness character.
- At the 50th Anniversary of the Wilderness Act, the Refuge System will be able to say it is measuring the character of wilderness areas within its jurisdiction.

Management Recommendations and Underlying Assumptions

- Funding and effort for Wilderness Fellows and the training of refuge staff through 2014 so that all wilderness refuges can establish a baseline.
- Working with other agencies to develop the wilderness character measures database from a desktop version to a centralized web application.
- Collaboration needs to be expanded to include BLM and USFS, particularly for training and database development.

Vision for next phase (where we will go from here)

- Institutionalize training for wilderness character monitoring with videos and a handbook, in the same way we have done for ServCat.
- Involve more members of the I&M staff in the introductory Carhart interagency training.
- Become fully engaged in the planning of the 50th Anniversary of the Wildlife Act, demonstrating how we can use monitoring to measure changes in wilderness character.

Wilderness Character Monitoring - visual display of task time line											
										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
WCM 1.0											
	1.1	Blue fill	→	Red fill						high	medium
	1.2		Blue fill	→	Red fill					medium	low
	1.3				Blue fill	Red fill				low	low
	1.4			Blue fill	→	Red fill				high	low
WCM 2.0											
	2.1			Blue fill	→	Red fill				minimal	medium
	2.2				Blue fill	→	Red fill			high	low
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Surrogate Species Monitoring (SSM)

Goal: Ensure that surrogate species monitoring surveys on refuge lands are scientifically credible, evaluate refuge contributions to local, regional, and landscape scale population and habitat objectives, and are coordinated across the landscape with other Service programs and our partners. The data will be used to assess the size, distribution, and status of the selected populations and to gauge the success of management and conservation efforts.

SSM 1.0 Support the surrogate species selection and implementation process to ensure conservation objectives are met.

SSM 1.1 By the end of January 2013, the NRPC I&M staff will provide input into surrogate species guidance document.

SSM 1.2 Beginning in FY13, the I&M staff will integrate the surrogate species monitoring with station IMPs and implement where appropriate. This will be an ongoing task and will coordinate with the I&M Planning focus area.

SSM 1.3 Beginning in FY13, where appropriate, the I&M Team will assist with the evaluation of assumptions underlying the choice of surrogate species.

SSM 1.4 Beginning in FY14, where appropriate, the I&M staff will assist with the monitoring process (protocol development, implementation) for surrogate species. This will be an on-going task and will align with the I&M Planning focus area.

SSM 1.5 Beginning in FY15, where appropriate, the I&M Team, in collaboration with regional science teams, will assist with the studies to assess the effectiveness of the surrogate species approach.

Why is I&M doing this?

- Surrogate species provide the Service with a “compass point” to be more focused on common goals.
- To promote and conduct effective landscape level conservation with limited resources
- First step in SHC implementation.

What advantages/benefits will refuges and managers see as a result of implementation?

- Savings in staff time and refuge resources.
- Structured approach for contributing to a larger conservation framework.
- Allow field stations to see how they contribute to species conservation at landscape and larger scales.

Management Recommendations and Underlying Assumptions

- This monitoring will go beyond the boundaries of Service lands, so need to develop this with partners.
- Employ an inclusive approach within Service and with our conservation partners in the selection process.
- Collaboration through LCCs on species selection process will be important.
- Clear agreement on what we are defining as our surrogate species is needed.

- Partner with the Office of the Science Advisor to do the monitoring for this surrogate species initiative.
- Surrogate species are one piece of what needs to be monitored, as refuge mandates will still need to be addressed.

Vision for next phase (where we will go from here)

- Continued support and integration of surrogate species monitoring with IMPs.

Surrogate Species Monitoring - visual display of task time line											
										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
SSM 1.0											
	1.1									low	minimal
	1.2									low	medium
	1.3									medium	medium
	1.4									medium	medium
	1.5									medium	medium
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Fire Monitoring (FM)

Goal: Ensure that monitoring data can be used to define historic and future fire risks on refuges and is coordinated across the landscape with other Service programs and our partners. The data will also be used to gauge the success of management and recovery efforts.

FM 1.0 By the end of FY18, the I&M Team will collaborate with fire program staff to generate fire history atlases for at least 10 high priority refuges.

FM 1.1 By the end of FY13, will evaluate the current process used to generate fire history atlases.

FM 1.2 By the end of FY13, in collaboration with the Fire Team, identify and prioritize refuges that would benefit from having a fire history atlas.

FM1.3 By the end of FY18, generate fire history atlases for at least 10 high priority refuges.

FM 2.0 Work with the Fire Team to develop a consistent approach to assess fuel treatment information and ensure that protocols are scientifically defensible and link to management objectives by the end of FY19.

FM 2.1 By the end of FY16, in collaboration with the Fire Team, identify and prioritize refuges with the largest need to conduct fire effects and other fuel treatment monitoring.

FM 2.2 In collaboration with the Fire Team, ensure that protocols used to address fuel treatments are linked to management objectives meet the minimum standards as defined by the I&M Survey Protocol Handbook by the end of FY17.

FM 2.3 By the end of FY18, estimate the funding (includes staff time) necessary to implement a consistent monitoring approach on priority refuges.

FM 2.4 By the end of FY19, in collaboration with the Fire Team, and other partners as appropriate, develop a consistent process for interpretation and roll-up of the Fire effects information.

FM 2.5 By the end of FY19, assist the Fire Team with assessing data information storage needs and in defining the minimum set of core data fields needed to provide consistent fuel treatment information across the Refuge System.

Why is I&M doing this?

- Documenting fire regimes – location, extent, severity and frequency of fire – can facilitate understanding of effects on wildlife, their habitats, and interaction with other ecological processes.
- Wild fires are a major expenditure for DOI and USFS and the projected increase in frequency, intensity, and extent will be a major factor in a changing landscape under climate change.
- Ensure AM principles are incorporated into fire monitoring, when feasible.
- Identify level of need to gauge effort and funding allocated to achieve data gathering
- Work with fire staff to develop fire-monitoring protocols linked to Rx management treatments on refuges.
- Assist Fire Program in developing protocols, guidance and databases to address the core monitoring variables identified in the Fire Monitoring Plan.

What advantages/benefits will refuges and managers see as a result of implementation?

- Managers will have a better understanding of their Refuge's vulnerability to fire risk and how to manage prescribed burns
- Standardized monitoring protocols used across the System will improve staff efficiency. As fire program staff move between stations they will not need to learn new procedure thus they can hit the ground running upon arrival at their new station.

Management Recommendations and Underlying Assumptions

- The Fire Program maintains a fire management information system (FMIS) that is currently being revised to incorporate geospatial data to facilitate fire atlas development in the future.
- The implementation of the I&M zone system staffing recommendation is essential for data management, analysis and conducting training to refuge fire staff on using the standardized protocols.
- Fire occupies two different roles: prescriptive fire is a management tool, and wild land fire as natural process to be better understood given expected changes in fire regimes due to climate change.
- There is disconnect between how fire management is funded (# acres burned) and what the objectives are for using fire to manage habitats.

Vision for next phase (where we will go from here)

- Improve efficiencies in generating and maintaining fire history for each refuge.
- Implement standardized fire effects monitoring across the System and incorporate these data into decision support and analysis tools for assessing the success of refuge management objectives.

Fire Monitoring - visual display of task time line										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
FM 1.0											
	1.1									low	low
	1.2									low	low
	1.3			2	2	2	2	2		very high	low
FM 2.0											
	2.1									low	low
	2.2									medium	medium
	2.3									high	high
	2.4										
	2.5										
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Coastal Marine Systems (CMS)

Goal: Collect baseline ecological and environmental data to evaluate potential impacts of climate change and other stressors on wildlife and their habitats within coastal and marine systems.

CMS 1.0 Coordinate with national and international conservation partners to establish, enhance, and sustain implementation of long-term survey activities to evaluate potential impacts of climate change and other stressors on wildlife and their habitats within coastal and marine systems.

CMS 1.1 By the end of FY14, the I&M Team will assign a working group to evaluate the Surface Elevation Table (SET) monitoring protocol currently being developed by NPS, USGS, and NOAA-NGS, and revise and format as needed to meet the I&M Survey Protocol Handbook standards.

CMS 1.2 By the end of FY14, the I&M Team, in collaboration with the Service Ocean and Marine National Coordinator will identify capabilities of the Integrated Ocean Observing System (IOOS) and Alaska Ocean Observing System (AOOS) stations located within or near refuges and incorporate relevant data generated by these monitoring networks into Refuge System I&M databases for analysis as needed.

CMS 1.3 By the end of FY15, in collaboration with the Service Ocean and Marine National Coordinator, participate in assessment of the current Sea Level Affecting Marshes Model (SLAMM) and its benefits to refuges, and provide recommendations for the next steps.

CMS 1.4 By the end of FY16, the I&M Team will identify coastal and remote island refuges requiring seawater abiotic (e.g., temperature, DO, pH, salinity, CO₂) and biotic (e.g., bacteria, nutrients, sediment) water quality monitoring to assess present and future impacts from climate change and anthropogenic sources (e.g., hazardous spills, energy developments) and natural disturbances (e.g., hurricanes) to coastal and marine resources. The team will also recommend an implementation strategy.

CMS 1.5 By the end of FY17, work collaboratively with the Service Ocean and Marine National Coordinator and NOAA to identify existing protocols, or identify those that need to be developed, for monitoring the status and trends in health of coastal and marine habitats (e.g., saltmarshes, coral reef systems) on or near refuges.

CMS 1.6 By the end of FY17, in coordination with the Service Ocean and Marine National Coordinator, the I&M Team will initiate partnerships with other national and global organizations involved with planning and implementation of monitoring of coastal and marine systems (e.g., Global Coral Reef Monitoring Network [GCRMN]) to leverage resources, coordinate protocols (when applicable) and share data.

Why are we doing this?

- Sea level rise is recognized as a major impact of climate change that will likely affect refuge lands and resources.

- The study and modelling of sea level rise is a global process that can benefit from collaboration across refuges, regions, and partners.
- Sea level rise and related coastal impacts are predicted to have significant effects to coastal resources and users of those resources.
- One of the goals of Refuge System I&M Initiative is to build partnerships to leverage resources and maximize efficiencies. With 180 ocean and coastal-based refuges and marine national monuments, it is imperative that the Refuge System establish partners in the oceanic observation community, including IOOS.
- Provide a dynamic baseline for natural resources associated with coastal areas and open seascapes that can be used to assess impacts of anthropogenic activities and natural disturbances.

What advantages/benefits will refuges and managers see as a result of implementation?

- Monuments and remote refuges in the Pacific are found within extremely large seascapes and to a large extent we are dependent upon conservation partners (e.g., NOAA) to access them through coordinated monitoring activities. It is essential that I&M integrate with established monitoring programs/networks being implemented by other agencies and entities in order to determine the status and trends in abiotic parameters and biotic resources over time.
- Because baseline conditions of natural resources in marine and coastal areas will likely shift over time as a result of a number of factors, biotic and abiotic monitoring would need to be long-term efforts in order to maintain accurate information on existing conditions.

Vision for next phase (where we will go from here)

- Design and implementation of a coordinated abiotic and biotic water quality monitoring effort to assess present and future impacts from climate change and anthropogenic sources (e.g., hazardous spills, energy developments) and natural disturbances (e.g., hurricanes) to coastal and marine resources. The team will also recommend an implementation strategy.

Coastal Marine Systems - visual display of task time line										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
CMS 1.0											
	1.1									low	low
	1.2									low	low
	1.3									minimal	low
	1.4									low	medium
	1.5									minimal	minimal
	1.6									low	low
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Refuge Condition Assessment (RCA)

Goal: That all field station periodically generate a standardized refuge condition assessment report that aligns with other land management status updates.

RCA 1.0 At least one field station in each region generates a refuge condition report by the end of 2016.

RCA 1.1 By the end of 2014, The I&M Team will establish a Condition Assessment (CA) working group to define purpose, scope, vision and time step for conducting refuge condition assessments.

RCA 1.2 By the end of 2014, the CA team will evaluate any regional condition assessment pilot projects that have been conducted to date.

RCA 1.3 By the end of 2015, the CA team will develop a standard set of core metrics and provide guidance for assessing refuge condition.

RCA 1.4 By the end of 2016, the I&M Team will conduct a system wide pilot for assessing refuge condition that involves at least one field station in each region.

RCA 2.0 40% of the field stations in each region will generate a refuge condition assessment report by the end of 2019.

RCA 2.1 By the end of FY17, the CA team will evaluate system wide pilot effort, refine metrics as needed, provide guidance for producing a refuge conditions assessment report.

RCA 2.2. By the end of FY19, 40% of the refuges will generate a refuge conditions assessment report. This is an annual task.

Why is I&M doing this?

- Provide refuge specific snapshots of the priority resources that a refuge manages for, either directly or indirectly.
- This is a good marketing tool.
- NPS, BLM and FS are creating similar 'report cards'. This enables I&M to compare status of common large 'bucket' items, such as water quality, across bureaus and agencies.
- To develop a standard set of metrics to be tracked across the refuge system, in addition to a subset of metrics that are unique to the individual refuge.
- This 'report card' format could serve multiple purposes and could be a tangible product of the I&M Initiative. It might be possible to summarize at the regional or LCC level as well.

What advantages/benefits will refuges and managers see as a result of implementation?

- The manager will be able to easily assess the status of priority resources and can use this information to inform future management actions and planning.

Management Recommendations and Underlying Assumptions

- We must develop practical metrics that do not place a burden on the field.

Vision for next phase (where we will go from here)

- Complete a refuge condition assessment report for all refuges.
- Explore if the report format can be used to ecosystem status at the LCC level.

Refuge Condition Assessment (RCA) - visual display of task time line											
											Estimated Effort
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19		NRPC Regional
RCA 1.0											
	1.1										low low
	1.2										low low
	1.3										low minimal
	1.4										low low
RCA 2.0											
	2.1										low low
	2.2										medium high
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

Wildlife Health (WH)

Goal: Develop a nationally coordinated monitoring effort that incorporates wildlife health surveillance, includes training Refuge System employees how to minimize the potential for disease transmission to other sites, and prevent the transmission of zoonotic agents; identification (or development) of a baseline database used to detect changes in disease expression; and identifying high risk areas likely to experience changes in pathogen and/or vector populations.

WH 1.0 Develop a wildlife health awareness training course to ensure that refuge staffs that handle wildlife are adequately trained to protect their own health and that of the animals they handle during morbidity and mortality event investigations by FY18.

WH 1.1 By the end of FY14, in keeping with the One Health concept, distributes guidance showing refuge staff basic biosecurity concepts and how to protect themselves from wildlife diseases. This task will be coordinated with the Bird Inventory and Monitoring Objective 4.0.

WH 1.2 By the end of FY18, in collaboration with the Refuge wildlife veterinarian, implement a certification process to ensure that Refuge System staff handling birds under their station banding permits meet the current North American Banding Council guidelines and certification requirements

WH 1.3 By the end of FY18, in collaboration with the Refuge wildlife veterinarian, implement process to ensure that Refuge System staff handling birds have taken the Service Wildlife Health Awareness Training course. Note – this requires coordination with Bird Inventory and Monitoring and may be broken into two separate objectives in the future.

WH 2.0 Ensure that Refuge Disease Contingency Plans are completed and available for integration into the CCP planning process by the end of FY18.

WH 2.1 By end of FY18, identify those refuges that need to develop or update disease contingency plans and assist with development to ensure plans are in place.

WH 2.2 By the end of FY14, identify existing monitoring protocols to be included in Refuge disease contingency plans and ensure protocols are stored in ServCat.

WH 2.3 By the end of FY18, institute a schedule to update refuge Disease Contingency Plans on a rolling basis (every 3 to 5 years).

WH 3.0 Work with Service wildlife disease specialists as well as state and federal wildlife agency partners (e.g., the USGS National Wildlife Health Center and the Refuge wildlife veterinarian) to help identify Refuge System monitoring needs and appropriate partners at local, regional, and national scales by FY20.

WH 3.1 By the end of FY16, identify existing avian monitoring projects that overlap with specimen collection needs in the development of health parameter, avian species-specific, and pathogen-specific investigations.

WH 3.2. By the end of FY18, work with partners to identify relevant wildlife health monitoring networks with which refuges may contribute to and benefit from.

WH 3.3 Identify areas of high risk for avian diseases on the landscape through the use of historical and current disease data by FY19.

Why is I&M doing this?

- Disease issues in wildlife populations can indicate environmental changes that might pose a threat to human health. Wildlife can also serve as a reservoir for diseases that affect humans and domestic animals. Most emerging diseases are zoonoses (i.e., diseases transmitted between animals and people), and wildlife disease surveillance can serve as an early warning system for potential outbreaks of novel or re-emerging pathogens affecting wild and domestic animals and humans.
- Climate change will have implications for disease transmission: pathogen range expansion, number of outbreaks, virulence. More refuges could potentially be affected by wildlife diseases and need to be prepared to recognize and respond to outbreaks.

What advantages/benefits will refugees and managers see as a result of implementation?

- Refuges will have improved access to information regarding current and historical outbreaks of wildlife disease.
- Refuge personnel will be better prepared in disease response with regard to biosecurity (containment) and personal safety.

Management Recommendations and Underlying Assumptions

- Development and maintenance of national (or international) disease surveillance networks and disease-tracking data systems should be the responsibility of wildlife disease experts within the Service in collaboration with their colleagues in federal and state agencies, universities, tribes, and NGO's.

Vision for next phase (where we will go from here)

- Disease surveillance will be integrated with other relevant I&M activities on refuges, e.g., water quality monitoring, and invasive species monitoring.

Wildlife Health - visual display of task time line											Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19		NRPC	Regional
WH 1.0												
	1.1										minimal	low
	1.2										low	medium
	1.3										minimal	low
WH 2.0												
	2.1										low	low
	2.2										low	low
	2.3										low	low
WH 3.0												
	3.1										minimal	minimal
	3.2										minimal	minimal
	3.3										low	minimal
Blue fill = estimated start												
Red fill = estimated completion												
Arrow = ongoing												
Values = estimated targets												
adopted 4 April 2013												
51												
Estimated Effort is ranked as none, minimal, low, medium, high, very high												

Air Quality Biomonitoring (AQB)

Goal: Implement a coordinated air quality biomonitoring (AQB) effort on refuge lands to provide assistance in prioritizing management of limited Service resources; enhance legal and policy-making decisions in light of climate change issues; and complement existing monitoring efforts underway by Branch of Air Quality (BAQ).

AQB 1.0 In collaboration with the Branch of Air Quality staff, determine if, or in what combinations, an active and/or passive air quality biomonitoring effort would best meet Refuge needs and provide a recommendation on next steps by the end of FY19.

AQB 1.1 By the end of FY17, the I&M Team in collaboration with the Branch of Air Quality will use a structured decision making process to delineate the question and objectives that an air quality biomonitoring initiative would address.

AQB 1.2 By the end of FY18, the I&M Team will implement the biomonitoring effort as recommended in AQB 1.1.

AQB 2.0 Branch of Air Quality will work with NRPC Water Resources Branch to determine how to best link air quality deposition monitoring with water quality monitoring by FY18.

AQB 2.1 By the end of FY18, the BAQ and NRPC Water Resources Branch will take the lead in collaboration with I&M to better integrate air quality deposition and water quality monitoring within the Refuge System. This task requires coordination with the Water Resources Team.

Why is I&M doing this?

- Air quality and water quality are linked through atmospheric deposition.
- Poor air quality affects biological resources.

What advantages/benefits will refuges and managers see as a result of implementation?

- A consistent air quality biomonitoring initiative will provide information directly on how poor air quality affects biological resources.

Management Recommendations and Underlying Assumptions

- This task will rely on the complete integration of programs and initiatives across the Service.

Vision for next phase (where we will go from here)

- Implement a consistent and integrated air quality biomonitoring initiative across the Refuge System.

Air Quality Biomonitoring (AQB) - visual display of task time line										Estimated Effort	
Objective	Task	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	NRPC	Regional
AQB 1.0											
	1.1									low	low
	1.2									medium	medium
AQB 2.0											
	2.1									low	minimal
Blue fill = estimated start											
Red fill = estimated completion											
Arrow = ongoing											
Values = estimated targets											
Estimated Effort is ranked as none, minimal, low, medium, high, very high											

U.S. Fish and Wildlife Service
National Wildlife Refuge System

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The Refuge System I&M Initiative works with others to assess the status of refuge lands, waters, and biota, and supports achievement of conservation objectives at multiple spatial scales.